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NATIONAL DAM SAFETY PROGRAM. BROWN DAM (NJ-00117), DELAWARE RIV--ETC(U)
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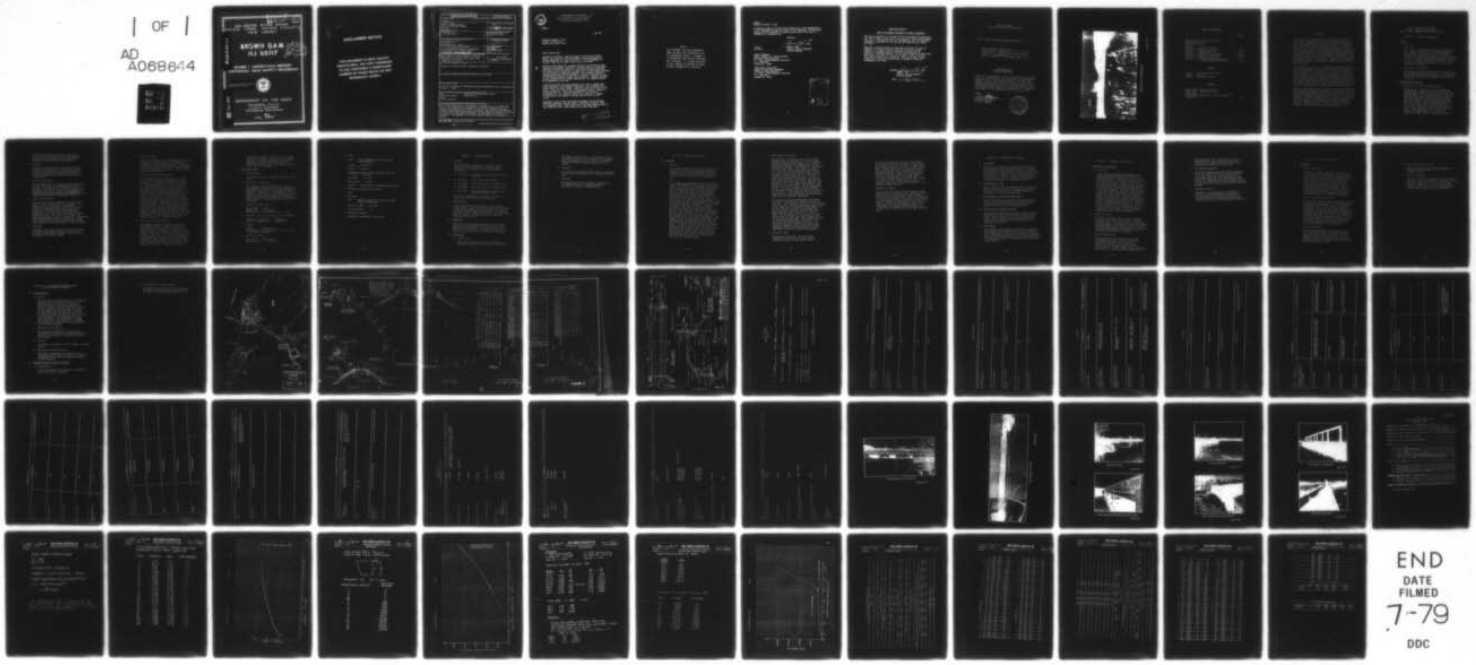

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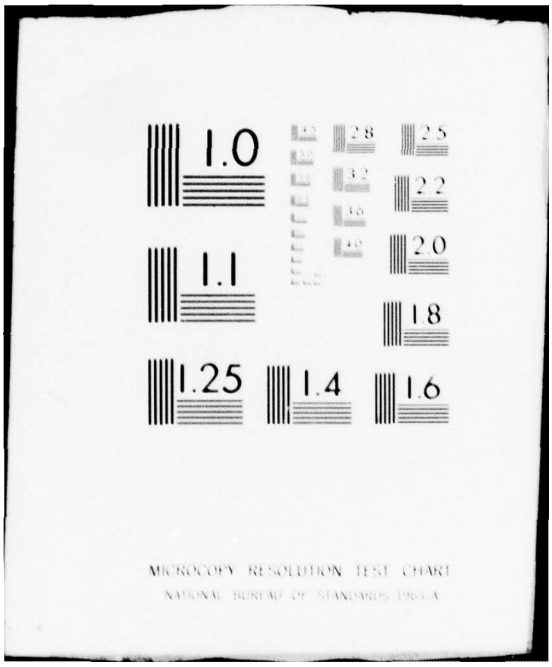
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DELAWARE RIVER BASIN
SALEM CREEK, SALEM COUNTY
NEW JERSEY

BROWN DAM
NJ 00117

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

May 1979

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REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: NJ00117
2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle): Phase I Inspection Report
National Dam Safety Program
Brown Dam
Salem County, N.J.

5. TYPE OF REPORT & PERIOD COVERED: (9) FINAL rept.

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s): (10) F. Keith Jolls, P.E.

8. CONTRACT OR GRANT NUMBER(s): (15) DACW61-78-C-0124

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Louis Berger & Assoc.
100 Halstead St.
East Orange, N.J. 07019

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: (12) 65p.

11. CONTROLLING OFFICE NAME AND ADDRESS
U.S. Army Engineer District, Philadelphia
Custom House, 2d & Chestnut Streets
Philadelphia, Pennsylvania 19106

(11)

12. REPORT DATE: May 1979

13. NUMBER OF PAGES: 60

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

(6) National Dam Safety Program. Brown Dam (NJ-00117), Delaware River Basin, Salem Creek, Salem County, New Jersey. Phase I Inspection Report.

15. SECURITY CLASS. (of this report): Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams
Structural Analysis
Safety
Visual Inspection
National Dam Inspection Act Report
Brown Dam, N.J.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE – 2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-D

4 MAY 1979

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Brown Dam in Salem County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Brown Dam, initially listed as a high hazard potential structure but reduced to a low hazard potential structure as a result of this inspection, is judged to be in good overall condition and the spillway is considered adequate. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. Based on the dam's overall condition and low hazard classification, no remedial actions are recommended at this time.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman William J. Hughes of the Second District. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

NAPEN-D
Honorable Brendan T. Byrne

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N. J. Dept. of Environmental Protection
P. O. Box CN029
Trenton, NJ 08625

John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N. J. Dept. of Environmental Protection
P. O. Box CN029
Trenton, NJ 08625

BROWN DAM (NJ00117)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 10 January 1979 by Louis Berger and Associates, Inc. under contract to the State of New Jersey. The state, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Brown Dam, initially listed as a high hazard potential structure but reduced to a low hazard potential structure as a result of this inspection, is judged to be in good overall condition and the spillway is considered adequate. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. Based on the dam's overall condition and low hazard classification, no remedial actions are recommended at this time.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 4 May 1979

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

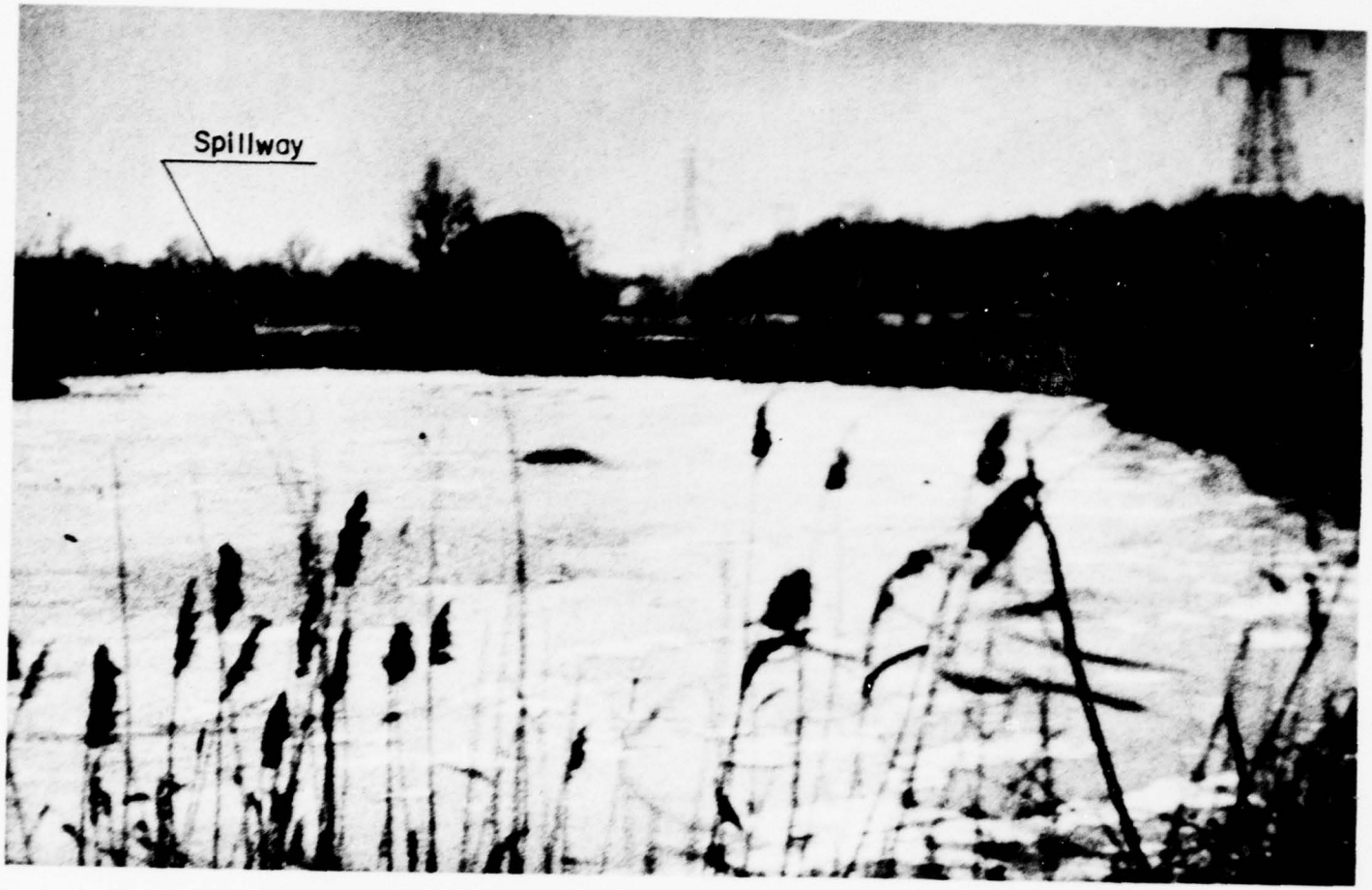
Name of Dam Brown Dam Fed ID# NJ 00117

State Located New Jersey
County Located Salem
Coordinates Lat. 3940.2 - Long. 7528.7
Stream Salem River
Date of Inspection 10 January 1979

ASSESSMENT OF GENERAL CONDITIONS

Brown Dam is assessed to be in a good overall condition and it is recommended to be downgraded to a low hazard classification. Overtopping would not increase the danger of downstream property damage. No detrimental findings were uncovered to merit further study. The combined spillway capacities of this dam and the Munson dam (which jointly impound the reservoir) are adequate to accommodate the selected 100-year design flood.

F. Keith Jolls P.E.
Project Manager



OVERVIEW OF BROWN DAM

JANUARY 1979

TABLE OF CONTENTS

FIGURES

APPENDIX

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
NAME OF DAM: BROWN DAM FED ID# NJ 00117

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with Contract FPM-36 between Louis Berger & Associates, Inc. and the State of New Jersey and its Department of Environmental Protection, Division of Water Resources. The State, in turn, is under agreement with the U.S. Army Engineer District, Philadelphia, to have this inspection performed.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of the Brown Dam and appurtenant structures, and to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

Brown Dam is a 45-year old earth embankment approximately 2,500 feet long with a 135 foot asphalt and concrete spillway located near the west abutment. The earthen dike has a 12-foot wide asphalt crest roadway the full length of the dam. There are wooden stop logs across the entire length of the depressed spillway which in effect, raise the depressed spillway (El. 7.5) to the overall crest elevation (El. 13.0). These are supported by vertical steel stanchions set in the concrete spillway apron. The embankment has an irregular alignment roughly following the easterly bank of the Salem River. This dam, together

with the Munson Dam located some two miles to the west on the Salem Canal, comprise the salt water tidal protection for the Dupont Chambers Works freshwater impoundment.

b. Location

Brown Dam is located three quarters of a mile south of Interchange No. 1 of the New Jersey Turnpike in Pennsville Township, Salem County. It is built across the Salem River west of Biddle's Landing along the west side of State Highway 540.

c. Size Classification

The maximum height of the dam is approximately 15 feet along the earth embankment and the total storage is estimated to be 19,460 acre-feet. Therefore, the dam is placed in the intermediate size category as defined by the Recommended Guidelines for Safety Inspection of Dams (storage capacity between 1,000 and 50,000 acre-feet).

d. Hazard Classification

Based on the Corps of Engineers criteria and the fact that in the event of a failure, little damage would be inflicted on downstream property or endanger human life, the classification is recommended to be downgraded to a low hazard. Below the dam, the Salem River discharges into a large, uninhabited salt-water marsh area and in the event of a failure the upland flood waters would be adequately accommodated. This classification makes no cognizance of the vital function the dam performs for the Chambers Works operation (see paragraph h of this Section).

e. Ownership

According to Division of Water Resources records the dam is owned and operated by E.I. Dupont de Nemours and Company, Chambers Works Division, Deepwater, New Jersey, 08023.

f. Purpose of Dam

This dam, together with the Munson Dam impounds a reservoir which serves as a freshwater storage for steam boilers involved in process operations and power generation at the Chambers Works and prevents salt water of the Delaware River from entering the supply during periods of extreme high tides.

g. Design and Construction History

Brown Dam was first constructed in 1935 by E.I. Dupont de Nemours and Company for the purpose of creating a freshwater reservoir for the Chambers Works. In 1949 the crest was raised to elevation +9.2, eliminating a former spillway and replacing it with a depressed weir section at elevation +7.5 with provisions for emergency stoplogs (up to elevation +9.0). During hurricane Hazel in October 1954, water from the Delaware River rose to a high tide of +11 which resulted in an overtopping and a 200 foot long breach (and which contaminated the storage reservoir with salt water). Dupont thereafter rebuilt the dam in 1955, raising the earth embankment to an elevation +13.0. Additionally, riprap was placed on both upstream and downstream slopes and the depressed spillway section was repaved. Modifications were made to the stop planks supports to raise them up to dam crest elevation. In 1959, and 1975 the crest was again brought up to grade and repaved.

h. Normal Operating Procedures

The extensive chemical plant facilities of the Chambers Works is completely dependent upon an adequate fresh water supply for their in-plant powerhouse. The supply must be kept free of salt contamination, hence the primary function of the dams is that of tidal barriers. The reservoir, along with Munson Dam and numerous injection wells maintains an adequate storage capacity as the plant must close down if the supply gets too low. The only operable gates are located at Munson Dam and are adjusted as required to maintain

prescribed reservoir levels (+4.8 in summer and +4.3 in winter). There are no operating facilities at Brown Dam and the low water mandatory outflow of the Salem River is diverted into the Salem Canal about one quarter mile north of Brown dam.

1.3 PERTINENT DATA

a. Drainage Area

The drainage area of Brown Dam is 60.0 square miles.

b. Discharge of Dam Site

The spillway capacity with the reservoir at the abutment top elevation is calculated to be approximately 2,450 cfs (with the flashboards removed). However, for the purposes of the hydraulic evaluation, it is assumed the flashboards are in a closed position, hence the effective discharge capacity is that of Munson Dam (2,030 cfs). No discharge records are available.

c. Elevation (Above M.S.L.)

Top of dam - +13.0
Normal pool - +4.8 (Max.)
Streambed at center line of dam - -2±

d. Reservoir (at El. 12.5; max. pool at Munson)

Length of normal pool - 5,000 feet
Length of maximum pool - 38,000 feet

e. Storage

Normal - 1,100 acre-ft.
Top of dam - 19,460 acre-ft. (at El. 12.5; controlled by Munson)

f. Reservoir Surface

Top of dam - 4,149 acres
Recreation pool - 171 acres

g. Dam

Type - Earth embankment with depressed paved spillway

Length - 2,500 feet

Height - 15 feet

Freeboard between normal reservoir and top of dam - 8.2 feet

Top width - 12 feet

Side slopes - 1½H:1V

Zoning - composition and compactness unknown

h. Diversion and Regulating Tunnel

None

i. Spillway

Type - Asphalt paved (over concrete) with timber flashboards.

Length of crest - 135 feet

Crest elevation - +7.5

j. Regulating Outlets

Removable flashboards in spillway.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The information available for review of the Brown Dam consisted of the following design drawings of the Chambers Works Engineering Department:

1) W 22553: Spillway Concrete Details, dated May 1933.

2) DW 7571: Earth Dike, August 1949.

3) DW 10343: Spillway Details, November 1954.

4) DW 10346: Dike Alterations, November 1954.

5) DW 13140: Dike Alterations, November 1959 (Revised October 1975).

No design computations, structural analyses or boring logs were available for review.

2.2 CONSTRUCTION

Little information was obtained on the actual construction. From the various revisions indicated on the design plans, the construction appeared to have been accomplished substantially in agreement with the design. There have been no apparent other major structural modifications since the 1975 repaving of the crest.

2.3 OPERATION

There is no day-to-day operation at this dam as the timber stoplogs are kept continuously closed under normal conditions. Releases during most periods of high inflow are made at the Munson Dam. However, the stoplogs are raised when necessary.

2.4 EVALUATION

a. Availability

Sufficient engineering data is available to ascertain the structural stability and assess

the dam's overall safety. No data was located upon which to base an assessment of the embankment permeability but in light of the modest height, the dike structure appears to be stable.

b. Adequacy

It is felt that the available data is sufficient to allow the rendering of the following assessment.

c. Validity

The validity of the information available is not challenged and is accepted without recourse to further investigations.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

The field inspection was held on January 10, 1979 with a subsequent inspection held on February 22nd to re-examine the reservoir conditions. The major elements of the dam appear to be in satisfactory condition.

b. Dam

The meandering embankment begins at the west edge of the natural bank of the Salem River (where the spillway is located) and continues in a southeasterly direction about 900 feet where it turns and runs due east approximately 1,000 feet until it again bends to the southeast and extends into the east abutment area just south of the Route 540 Bridge (No. 200, built in 1935). Here, it merges into an older highway embankment. The bituminous concrete crest roadway is in fairly good condition but the edges are ravelled and cracked in numerous locations. There is no vehicular traffic on the crest road except for occasional maintenance vehicles and the grade appears to be very level except for the last 200 feet near the east abutment which drops down about one foot where the dike merges into the highway embankment. The dumped riprap on each face is extensive and appears to be considerably thicker than the 24 inches minimum specified on the design plans. There is some secondary tree growth along the toes of slope and miscellaneous debris along the water line. At the time of inspection the water level on each side of the dam were roughly equal and a visit to Munson Dam at that time revealed the gates were open and discharging a considerable flow into the Delaware River.

c. Appurtenant Structures

The spillway is located at the right (west) abutment and is comprised of a 20 foot wide sloped concrete slab-on-grade on the upstream face which supports the steel posts of the flashboards (which are embedded in a continuous concrete grade beam. This rests on top of a 10-foot wide concrete spillway slab which is 3.5 feet below the spillway crest (+7.5). The apron is poured on top of a sheet piling cofferdam which extends the full 135 foot width of the depressed spillway. During the 1954 reconstruction, additional sheet piling was driven along each end of the spillway and additional fill and riprap were placed in the adjacent transition zones. The sheeting was driven in 20-foot lengths into the underlying marine tidal marsh deposits which normally are slightly greater than 10 feet in thickness in this area. The underlying alluvial silty sands are in a layered system and comprised of Cape May and Bridgeton formations.

The spillway crest is paved with bituminous concrete in the exposed, visible portions at each end. The concrete apron is in satisfactory condition with only minor cracking observed. As can be seen from the appended photographs, all of the timber stop logs are maintained in position within vertical steel 6 WF20 posts whose spacing varies from 5'-3" to 9'-9". There are 20 sections of stop logs with nine having steel lifting beams positioned above the axis of the spillway. The timber walk and railing immediately below the stop logs is in an old but satisfactory condition. It was noted that the stop logs in the raised position somewhat restrict the outflow but subsequent hydraulic determination revealed that this would be of little consequence.

d. Reservoir Area

Upstream from the dam, the Salem River extends westward about 900 feet while immediately north of the right abutment

inflow into the reservoir pool enters under the County Bridge No. 200 which is positioned just north of the left abutment. This somewhat isolated reservoir area is roughly 1,500 feet on each side and is a low-lying marshy area with several small islands and an ill-defined shoreline. Much of the surrounding terrain is slightly below the dam crest elevation and the Route 540 bridge has only a 3.5 foot freeboard above normal pool. East of Route 540, the upper reaches of the reservoir area are a further extension of the marshy wetlands terrain.

e. Downstream Channel

South of the dam, the natural channel of the Salem River broadens into the tidal marshlands of the Pine Island and Kates Creek meadows which are over a mile wide. The river continues to flow south several miles where it discharges into the Delaware River north of the town of Salem. As the dam effectively blocks off all low-level flow, this downstream portion is essentially a brackish estuary subject only to the tidal fluctuations of the upper Delaware Bay.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The dam is operated by engineering personnel of the Chambers Works staff who maintain a 24-hour surveillance of the reservoir level. In general, the reservoir is purged twice daily during periods of low tide to maintain the prescribed design pool elevation. There is no day-to-day operation at the study dam as the spillway stop logs are normally maintained in a closed position.

4.2 MAINTENANCE OF DAM

Dupont inspects the dam periodically and after all heavy storms. Because of the passive nature of operation, there is little up-keep required or maintaining of day-to-day records.

4.3 MAINTENANCE OF OPERATING FACILITIES

The only operational facilities are the twenty sets of stop log planking in the spillway which are maintained on an as-needed basis. They appear to be in a satisfactory condition.

4.4 DESCRIPTION OF WARNING SYSTEM

None exists except for monitoring by the Dupont engineering staff during periods of heavy storms, either from upland flows or from extreme high tides. The elaborate warning system at Munson dam serves as an effective warning system to operating personnel.

4.5 EVALUATION

The present operational and maintenance procedures are deemed to be adequate in view of the hazard classification and lack of any downstream development. The Dupont engineering staff have experienced, well-managed personnel whose chief responsibility is maintenance and safe guarding of the fresh-water supply system.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

Based upon the Recommended Guidelines for Safety Inspection Dams, Brown Dam is of intermediate size and is placed in the low hazard category. A 100-year frequency event was selected as the design storm by the inspecting engineer. Inflow to the reservoir was calculated using precipitation data from Technical Paper 40 and NOAA TM NWS Hydro 35 by the HEC-1 computer program, which yielded a peak of 5,680 cfs. When the inflow hydrograph was routed through the reservoir, discharge was jointly controlled by both the Munson and Brown dams. Routing reduced the peak to 1,390 cfs while the combined spillway capacities before overtopping of either dam occurs is approximately 2,030 cfs. However, it was assumed for the purpose of evaluation that the stoplogs at the study dam are in a closed position. Thus, the design storm is adequately accommodated, with a freeboard of approximately 2.7' feet available.

b. Experience Data

There are no stream flow records available for the Salem River and no recent recorded instance where the dam has been overtopped due to upland flow. Dam Application No. 481 (dated December 1954) stated that hurricane Hazel of that year pushed tide waters up to El. +11 below the dam and breached the embankment and contaminated the fresh water supply.

c. Visual Observations

It was noted by the inspection team that considerable portions of the surrounding countryside and residential areas in Deepwater and parts of the Salem canal banks are at or slightly below the top of dam elevation. Hence flooding which approached crest height would additionally inundate the

surrounding terrain. The entire area is extremely flat, as evidenced by the ratio of storage areas between the normal and flood pool storage capacities (see 1.3.e).

d. Overtopping Potential

Since the combined spillways can accommodate the design flood and the surrounding terrain is so low, there is little potential for overtopping the dam crest from upland flows. The top of Brown Dam is 0.5 foot higher than Munson Dam reflecting its more exposed position to open sea storms and wind conditions from the south.

e. Drawdown Potential

Drawdown of the Salem Canal and reservoir can only be accomplished at Munson Dam. It is not possible to estimate a meaningful drawdown time for the reservoir due to the large variations in tidal tailwater conditions.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION

a. Visual Observations

Although the main structural elements of Brown Dam are 45 years old, it is in a good overall condition reflecting the continued high caliber of maintenance. Although little except the top portions were visible, the steel sheeting is in true alignment and the exposed surfaces show little evidence of excessive oxidation, indicating a good grade of marine structural steel. The exposed concrete within the spillway is in a satisfactory condition as is the catwalk. The dam embankment crest roadway is at true grade with only minor cracking evidenced.

b. Design and Construction Data

The available design plans furnished by Dupont indicate the major details of construction. It is unknown exactly what earlier construction existed at the site but this is relatively unimportant in view of the modest height of structure. No design information was available regarding the assumptions made or allowable stresses employed. In view of its height it is conservatively designed, especially in view of the limited scour potential. Except for the open-sea exposure to the south, it is felt that the structure is in little danger of structural damage from flood waters.

c. Operating Records

The dam has performed satisfactorily since its installation under all conditions and there is little basis to question the conservatism of the original design. As previously stated, the Chamber Works Engineering Department maintains close supervision of the dam and operating records.

d. Post Construction Changes

There has been no recent post construction changes since the paving of the crest roadway in 1975.

e. Seismic Stability

The dam is located in Seismic Zone 1 and due to its low height, has negligible potential vulnerability to seismic loadings. Experience indicates dams in Zone 1 will have adequate stability under dynamic loading conditions if stable under static loading conditions.

SECTION 7 - ASSESSMENTS/RECOMMENDATIONS/ PROPOSED REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety

The Brown Dam is assessed to be in an adequate structural and hydraulic condition. The combined spillway capacities, together with the Munson Dam, can accommodate the 100-year frequency design flood and there is little likelihood that the dam would ever be overtopped from upland flows. There is no downstream hazard potential should the structure collapse and consequently, the dam is recommended to be downgraded to a low hazard category. No detrimental findings were revealed in this inspection to render a questionable judgement as to the hydraulic or structural adequacy.

b. Adequacy of Information

The information gathered for the Phase I inspection is deemed to be adequate regarding the safe operation and structural stability of the dam.

c. Urgency

No urgency is attached to the findings contained herein.

d. Necessity for Further Study

Additional inspections are believed to be unnecessary as the dam is does not constitute a hazard to human life or a danger to downstream property.

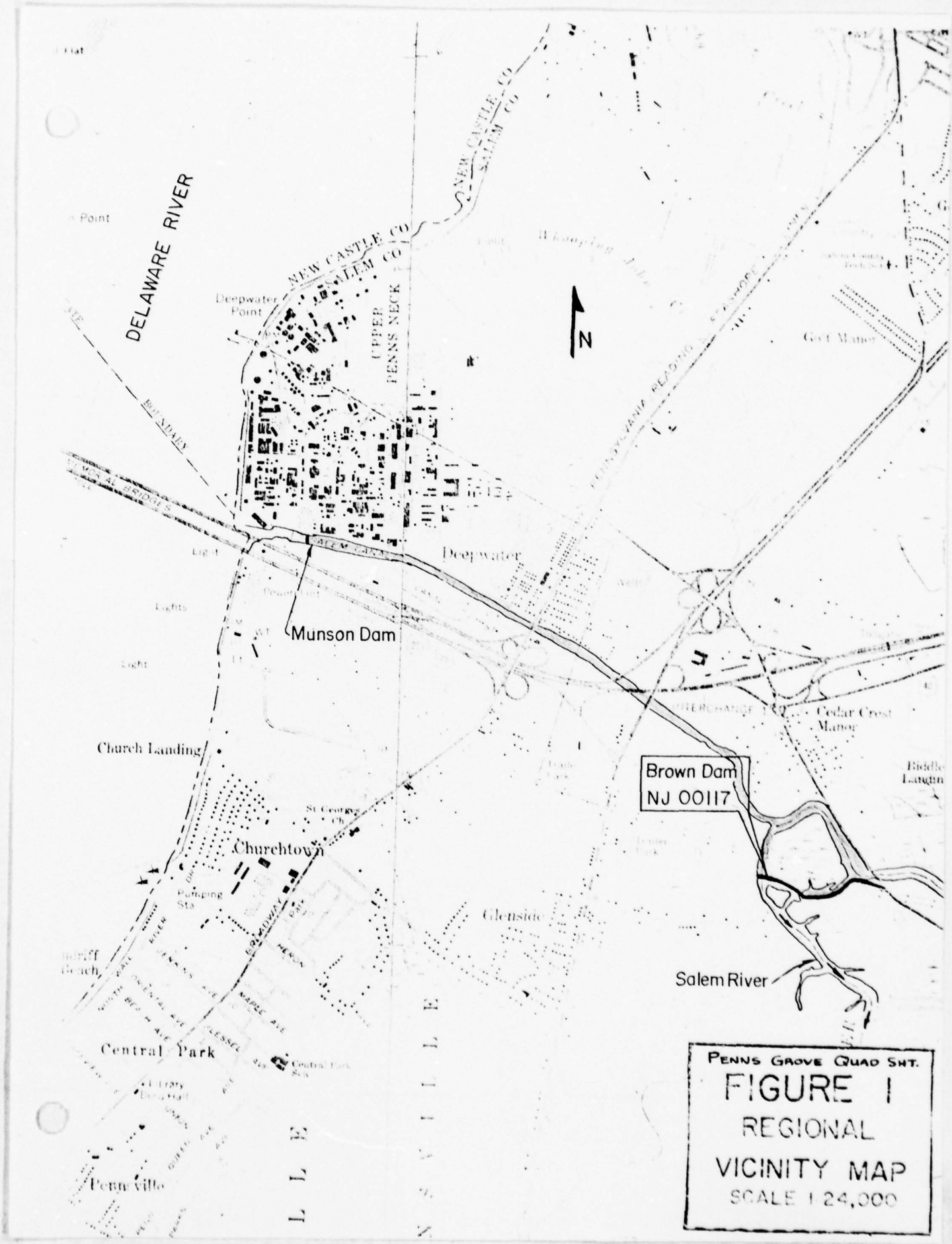
7.2 RECOMMENDATIONS/REMEDIAL MEASURES

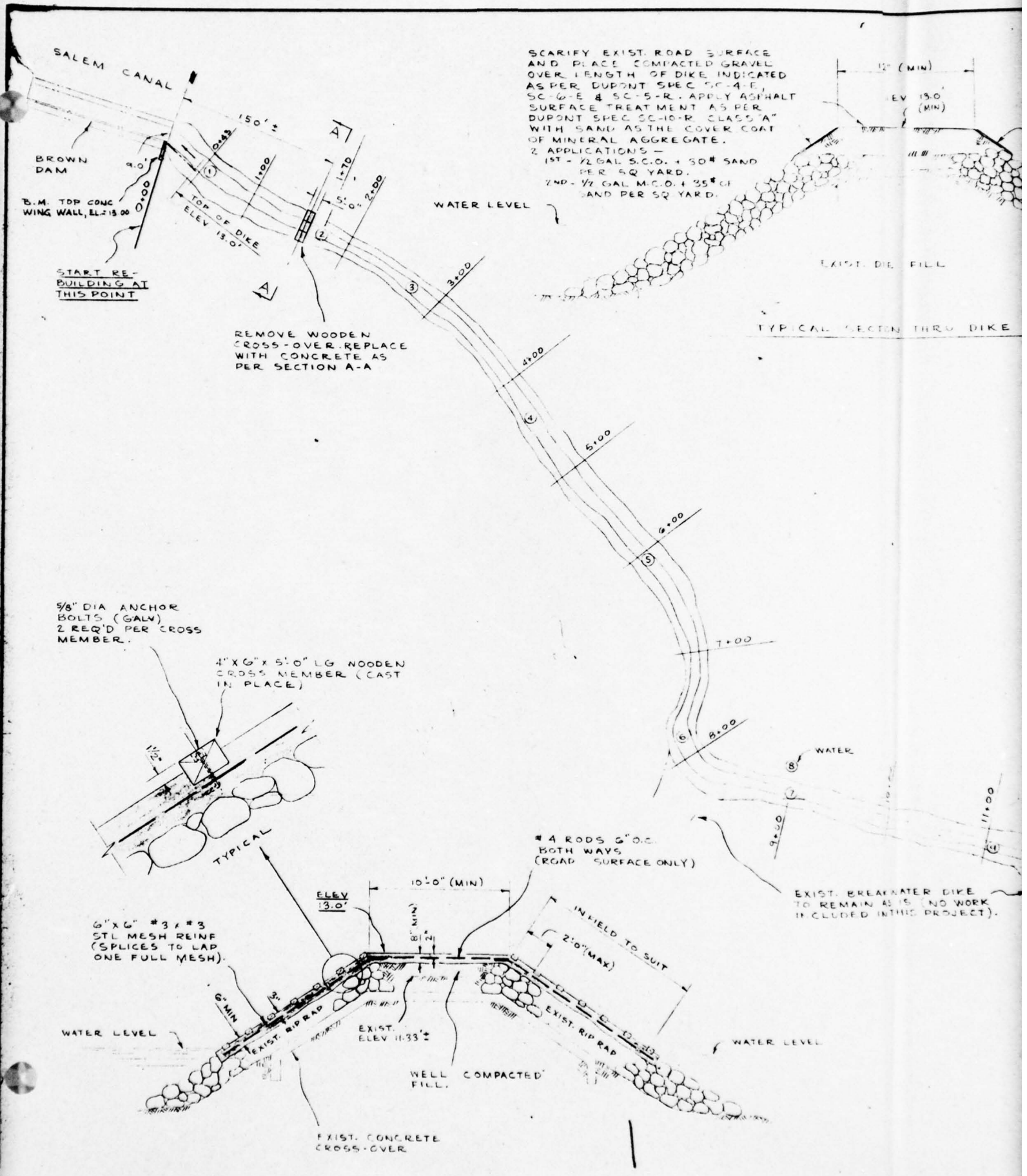
a. Alternatives

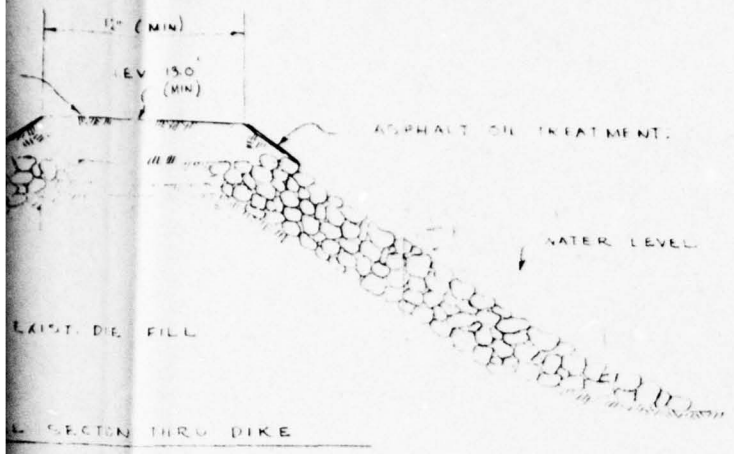
None are envisioned in the way of recommendations or remedial measures.

b. O&M Maintenance and Procedures

No additional procedures other than those currently in effect appear to be warranted in light of the above assessment.


DELAWARE RIVER
NEW CASTLE CO
SALEM CO
Deepwater Point
UPPER PENNS NECK
N
Munson Dam
Deepwater
Church Landing
Churchtown
Brown Dam
NJ 00117
Cedar Crest Manor
Glenside
Salem River
Central Park
Pennsville
PENNS GROVE QUAD SHT.
FIGURE 1
REGIONAL
VICINITY MAP
SCALE 1:24,000


SALEM CANAL
150'±
BROWN DAM
9.0'
B.M. TOP CONC WING WALL, EL.=13.00
0+00
0+43
1+00
1+70
2+00
5'-0"
TOP OF DIKE ELEV 13.0'
START RE-BUILDING AT THIS POINT
REMOVE WOODEN CROSS-OVER. REPLACE WITH CONCRETE AS PER SECTION A-A
SCARIFY EXIST. ROAD SURFACE AND PLACE COMPACTED GRAVEL OVER LENGTH OF DIKE INDICATED AS PER DUPONT SPEC SC-4-R, SC-6-R & SC-5-R. APPLY ASPHALT SURFACE TREATMENT AS PER DUPONT SPEC SC-10-R CLASS "A" WITH SAND AS THE COVER COAT OF MINERAL AGGREGATE.
2 APPLICATIONS —
1ST - 1/2 GAL S.C.O. + 30# SAND PER SQ YARD.
2ND - 1/2 GAL M.C.O. + 35# CL SAND PER SQ YARD.
WATER LEVEL
12' (MIN)
EL 13.0' (MIN)
EXIST. DIKE FILL
TYPICAL SECTION THRU DIKE
3+00
4+00
5+00
6+00
7+00
8+00
5/8" DIA ANCHOR BOLTS (GALV) 2 REQ'D PER CROSS MEMBER.
4" X 6" x 5'-0" LG WOODEN CROSS MEMBER (CAST IN PLACE)
1 1/2"
TYPICAL
#4 RODS 6" O.C. BOTH WAYS (ROAD SURFACE ONLY)
10'-0" (MIN)
ELEV 13.0'
8" MIN
INFIELD TO SUIT
2'-0" (MAX)
6" X 6" #3 x #3 STL MESH REINF (SPLICES TO LAP ONE FULL MESH).
6" MIN
EXIST. RIP RAP
EXIST. ELEV 11.33'±
WATER LEVEL
WELL COMPACTED FILL.
EXIST. CONCRETE CROSS-OVER
WATER
9+00
11+00
EXIST. BREAKWATER DIKE TO REMAIN AS IS (NO WORK INCLUDED IN THIS PROJECT).



SECTION THRU DIKE

ELEVATIONS ON EXISTING DIKE

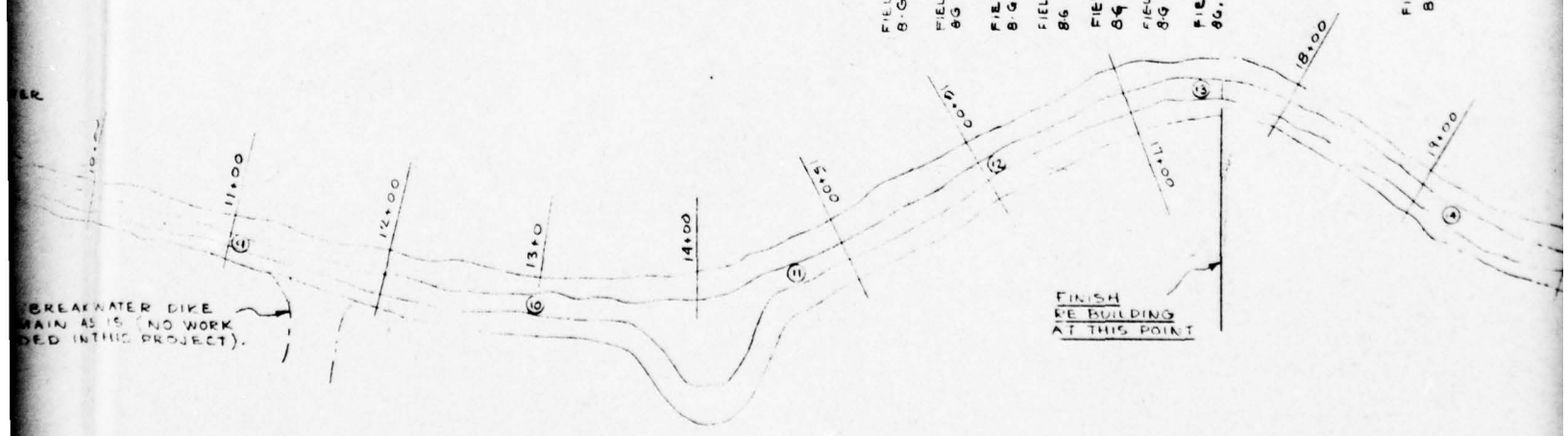
SURVEY REPORT

POINT	11/4/61	9/13/62	6/18/62	12/17/62	6/25/63	9/23/64	6/1/65
1	11.3	11.6	12.8	12.7	12.7	12.5	12.36
2	11.33	13.00	12.39	12.34	12.28	12.08	11.90
3	12.3	12.6	12.6	12.5	12.5	12.2	12.01
4	12.7	12.1	12.1	12.0	12.0	11.8	11.57
5	11.0	12.2	12.5	12.4	12.4	12.1	11.81
6	10.4	11.6	12.2	12.15	12.0	11.7	11.45
6⅓	10.4	—	—	—	—	—	
6⅔	10.5	—	—	—	—	—	
7	10.4	12.2	12.2	12.2	12.0	11.8	11.68
7⅓	10.8	—	—	—	—	—	
7⅔	11.2	—	—	—	—	—	
8	4.7	—	5.4	4.9	4.3	1.2	5.43
9	11.7	12.3	12.8	12.8	12.6	12.3	12.20
9⅓	12.3	—	—	—	—	—	
9⅔	12.8	—	—	—	—	—	
10	13.1	13.0	13.5	13.45	13.4	13.3	13.33
11	12.6	12.9	13.4	13.35	13.3	13.0	12.90
12	12.8	13.1	13.8	13.8	13.8	13.5	13.52
13	13.3	—	14.1	14.05	14.1	13.7	13.82
14	12.9	—	13.3	13.2	13.2	13.1	12.87
15	12.3	—	12.2	12.05	12.1	12.1	12.11
16	11.0	—	11.8	11.75	11.8	11.7	11.77
17	10.7	—	11.6	11.5	11.5	11.5	11.40
18	10.3	—	11.3	11.1	11.1	11.0	10.83
19	10.5	—	—	—	—	—	
20	12.0	—	12.06	11.96	12.00	12.04	12.20
	FIELD BOOK BG Pg 7	FIELD BOOK BG P3-9	FIELD BOOK BG PG-28	FIELD BOOK BG P6-28	FIELD BOOK BG Pg-31	FIELD BOOK BG Pg 32	FIELD BOOK BG, Pg. 36

ELEVATIONS ON EX

	SURVEY
STA	10-2-75
0+00	9.16
0+43	12.17
1+00	11.82
2+00	11.52
3+00	11.62
4+00	11.12
5+00	11.37
6+00	11.62
7+00	11.29
8+00	11.05
9+00	11.43
10+00	11.73
11+00	12.33
12+00	12.98
13+00	13.23
14+00	13.23
15+00	13.58
16+00	13.73
17+00	13.98
18+00	12.98
19+00	13.13
20+00	12.28
21+00	11.88
22+00	11.58
23+00	11.38

FIELD BOOK BG, PG. 42



PLAN

SCALE 1" = 50'-0"

NOTE

ELEVS. TAKEN ON 10-2-75 WERE PRIOR TO APPLICATION OF F.A.B.C. CAP.

2

ATIONS ON EXISTING DIKE

SURVEY REPORT

9/15/69	9/18/62	9/17/62	9/23/63	9/23/64	6/1/69
11.6	12.8	12.7	12.7	12.5	12.36
13.30	12.39	12.34	12.28	12.08	11.90
12.6	12.6	12.5	12.5	12.2	12.01
12.1	12.1	12.0	12.0	11.8	11.53
12.2	12.5	12.4	12.4	12.1	11.8
11.6	12.2	12.15	12.0	11.7	11.45
—	—	—	—	—	
—	—	—	—	—	
12.2	12.2	12.2	12.0	11.8	11.68
—	—	—	—	—	
—	—	—	—	—	
—	5.4	4.9	4.3	1.2	5.41
12.3	12.8	12.8	12.6	12.3	12.20
—	—	—	—	—	
—	—	—	—	—	
13.0	13.5	13.45	13.4	13.3	13.33
12.9	13.4	13.35	13.3	13.0	12.90
13.1	13.8	13.8	13.8	13.5	13.52
—	14.1	14.05	14.1	13.7	13.12
—	13.3	13.2	13.2	13.1	12.81
—	12.2	12.05	12.1	12.1	12.11
—	11.8	11.75	11.8	11.7	11.71
—	11.6	11.5	11.5	11.5	11.40
—	11.3	11.1	11.1	11.0	10.83
—	—	—	—	—	
—	12.06	11.96	12.00	12.04	11.20

FIELD BOOK BG PG. 3

FIELD BOOK BG PG. 28

FIELD BOOK BG PG. 28

FIELD BOOK BG PG. 31

FIELD BOOK BG PG. 32

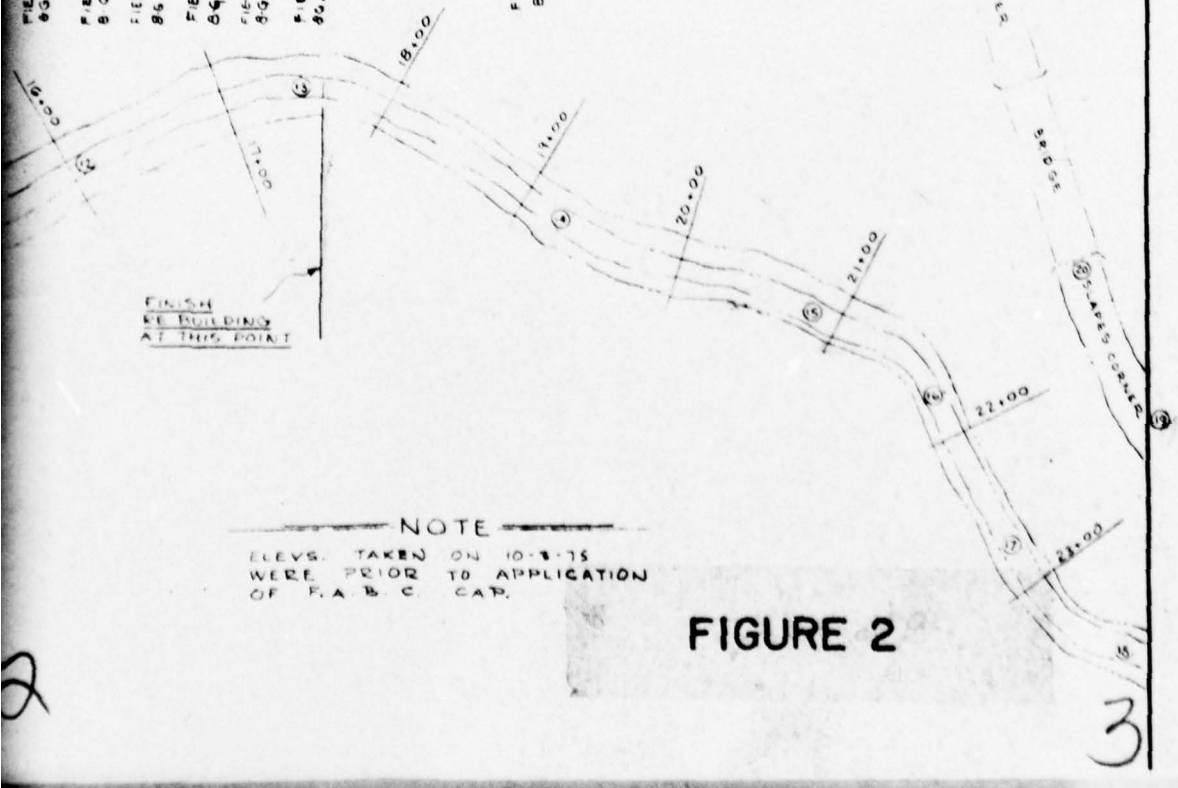
FIELD BOOK BG, PG. 36

ELEVATIONS ON EXISTING DIKE

SURVEY REPORT

STA	10-3-75					
0+00	9.16					
0+45	12.17					
1+00	11.82					
2+00	11.52					
3+00	11.62					
4+00	11.12					
5+00	11.37					
6+00	11.62					
7+00	11.29					
8+00	11.05					
9+00	11.43					
10+00	11.73					
11+00	12.33					
12+00	12.98					
13+00	13.23					
14+00	13.28					
15+00	13.58					
16+00	13.73					
17+00	13.98					
8+00	12.98					
9+00	13.13					
20+00	12.28					
21+00	11.88					
22+00	11.58					
23+00	11.38					

FIELD BOOK BG, PG. 42



NOTE

ELEVS. TAKEN ON 10-3-75 WERE PRIOR TO APPLICATION OF F.A.B.C. CAP.

FIGURE 2

2

3

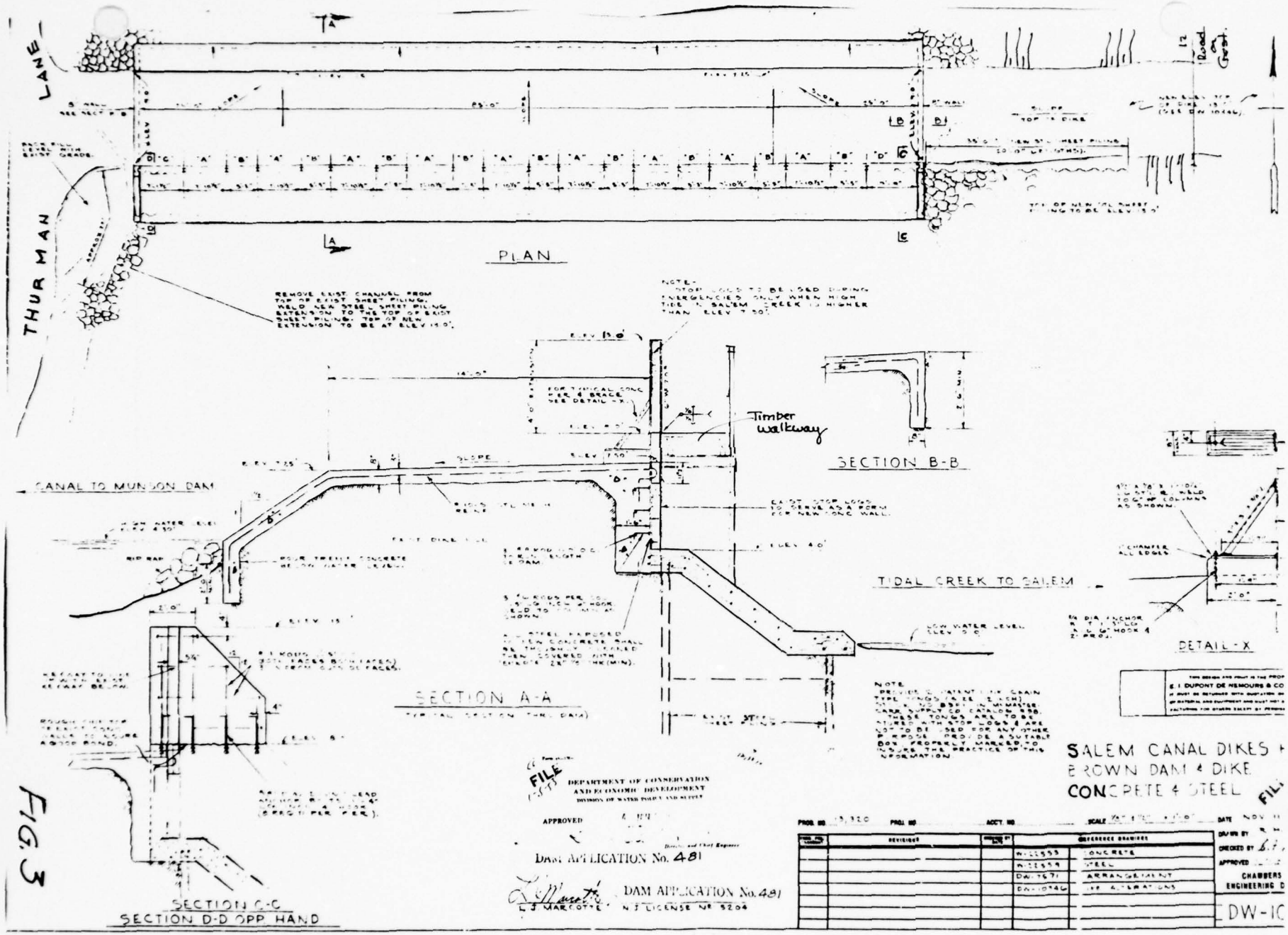

THUR MAN LANE
PLAN
REMOVE EXIST CHANNEL FROM TOP OF EXIST SHEET PILING; WELD NEW STEEL SHEET PILING EXTENSION TO THE TOP OF EXIST SHEET PILING; TOP OF NEW EXTENSION TO BE AT ELEV 13.0'.
NOTE: STOP LOGS TO BE USED DURING EMERGENCIES ONLY WHEN HIGH TIDE IN SALEM CREEK IS HIGHER THAN ELEV 7.50'.
Timber walkway
SECTION B-B
CANAL TO MUNSON DAM
TIDAL CREEK TO SALEM
SECTION A-A
DETAIL - X
SECTION C-C
SECTION D-D OPP HAND
FILE
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
APPROVED
DAM APPLICATION No. 481
DAM APPLICATION No. 481
L.J. MARCOTTE
N.J. LICENSE NO. 5204
E. I. DUPONT DE NEMOURS & CO
SALEM CANAL DIKES
BROWN DAM & DIKE
CONCRETE & STEEL
FILE
PROJ NO. 59.320
DATE NOV
DRAWN BY
CHECKED BY
APPROVED
CHAMBERS ENGINEERING
REVISIONS
REFERENCE DRAWINGS
W-22553 CONCRETE
W-22559 STEEL
DW-7671 ARRANGEMENT
DW-10746 AS ALTERATIONS
DW-1C

FIG 3

Check List
Visual Inspection
Phase 1

Name Dam Brown County Salem State New Jersey Coordinators NJDEP

Date(s) Inspection 10 Jan. 1979 / 22 Feb. 1979 Weather Cold Temperature 18°

Pool Elevation at Time of Inspection + 6± M.S.L. Tailwater at Time of Inspection + 7± M.S.L.

Inspection Personnel:

K. Jolls

R. Lang

E. Simone

K. Jolls Recorder

Dam No. 00117

EARTH EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEE PAGE ON LEAKAGE		Dam owned and operated by Dupont Chambers Works.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Satisfactory Concrete apron slab under sluice gates at west abutment.	
DRAINS	None	
WATER PASSAGES	None	Only spillway transmits flows. No other outlets.
FOUNDATION	Unknown	Steel sheeting at ends of gate structure.

EARTH EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Some cracking in spillway slab.	
STRUCTURAL CRACKING	None	
VERTICAL AND HORIZONTAL ALIGNMENT	Satisfactory	Structure founded on piling or cofferdam.
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Minor in asphalt.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Could not be observed. High tidal zone (covered with ice).	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Conditions of slopes very irregular. Not observed.	
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Satisfactory. Crest paved with 12' asphalt road. Good condition.	Little cracking observed.
RIPRAP FAILURES	Slopes vary (1:1) Some riprap, concrete blocks, and brick construction debris.	Appears plant deposes of good construction debris on slopes.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Satisfactory	
ANY NOTICEABLE SEEPAGE	No (both pools frozen)	
STAFF GAGE AND RECORDER	None observed	Dupont has bench mark controls in vicinity of dam.
DRAINS	N/A	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT		
INTAKE STRUCTURE	21 timber flashboards set in steel frames. 9 appear movable (have lifting bms above).	Maintained by Dupont as part of Salem Canal fresh water reservoir.
OUTLET STRUCTURE	135' spillway	Broad crested. Irish crossing road sill under timber flashboards.
OUTLET CHANNEL	Natural tidal marshlands. Ill-defined channel.	Outlet flows south into Delaware Bay.
EMERGENCY GATE	None	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	See previous page	
APPROACH CHANNEL	None	
DISCHARGE CHANNEL	None	
BRIDGE AND PIERS	None	City Bridge #200 on highway immediately downstream from east abutment. (3 span concrete reinf. concrete girder)

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None observed	
OBSERVATION WELLS	None observed	
WEIRS	None observed	
PIEZOMETERS	None observed	
OTHER	None observed	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Flat tidal marshlands area.	Dam impounds very large area. Boundaries could not be exactly ascertained in field.
SEDIMENTATION	Not observed (tidal flats)	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Ill-defined channel except immediately downstream from spillway.	Dam a part of fresh water/intake supply for Dupont (along with Munson dam).
SLOPES	Very flat	
APPROXIMATE NO. OF HOMES AND POPULATION	None - all tidal marshlands.	Definitely low hazard classification.

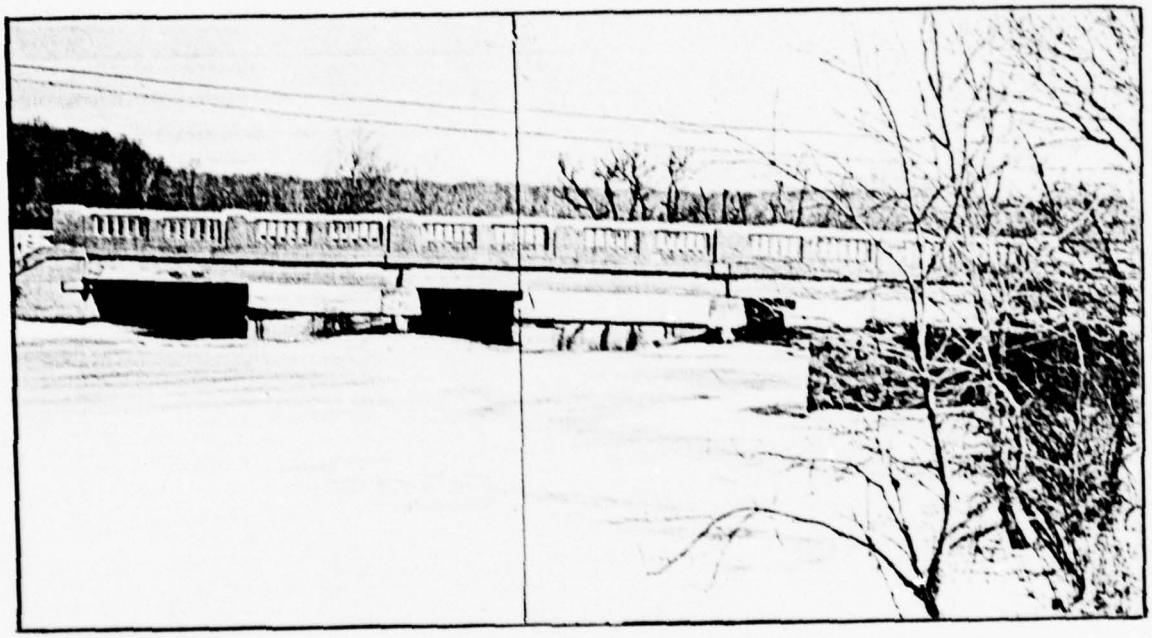
CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS	
PLAN OF DAM	Available	(All data marked available from Dupont Chambers Works, Deepwater, N.J. except where noted)
REGIONAL VICINITY MAP	Available	(Quad sht.)
CONSTRUCTION HISTORY	Available	
TYPICAL SECTIONS OF DAM	Available	
HYDROLOGIC/HYDRAULIC DATA	Some available	
OUTLETS - PLAN	Available	
- DETAILS	Available	
-CONSTRAINTS	Available	
-DISCHARGE RATINGS	Available	
RAINFALL/RESERVOIR RECORDS		

ITEM	REMARKS
SPILLWAY PLAN	Available
SECTIONS	Available
DETAILS	Available
OPERATING EQUIPMENT PLANS & DETAILS	Available

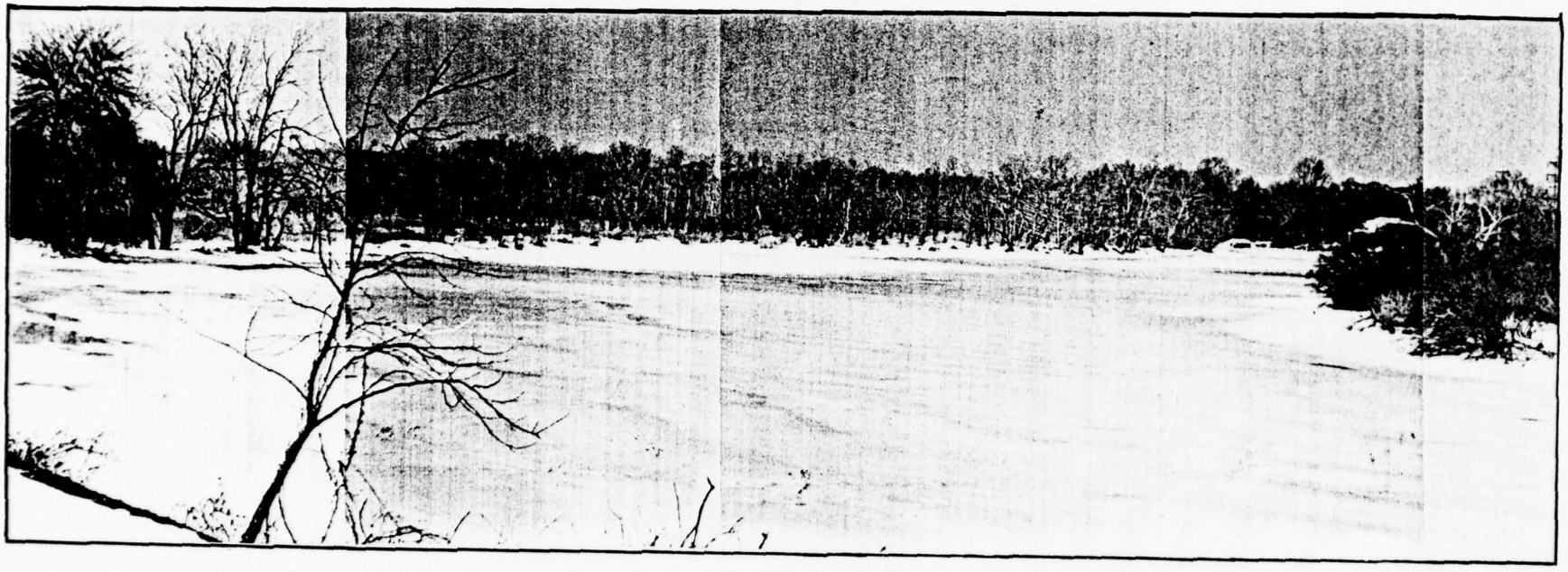
ITEM	REMARKS	
DESIGN REPORTS	None	
GEOLOGY REPORTS	None available	
DESIGN COMPUTATIONS	Some available	(NJDEP records)
HYDROLOGY & HYDRAULICS	Some available	
DAM STABILITY	Not available	
SEEPAGE STUDIES	Not available	
MATERIALS INVESTIGATIONS	None available	
BORING RECORDS	None available	
LABORATORY	None available	
FIELD	None available	
POST-CONSTRUCTION SURVEYS OF DAM	Available	
BORROW SOURCES.	Known	

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	Known
HIGH POOL RECORDS	Known
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Some available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	None available



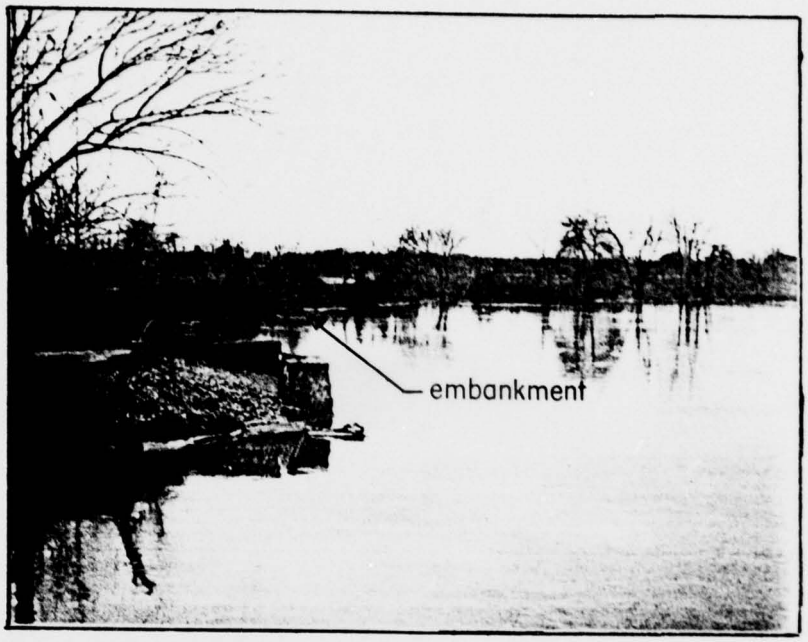
County bridge near right abutment

February 1979



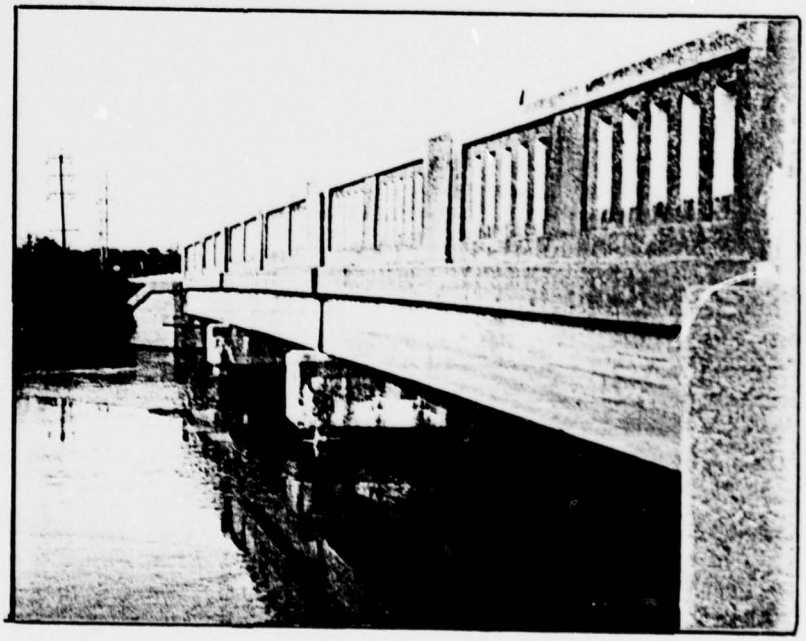
View upstream from dam

February 1979



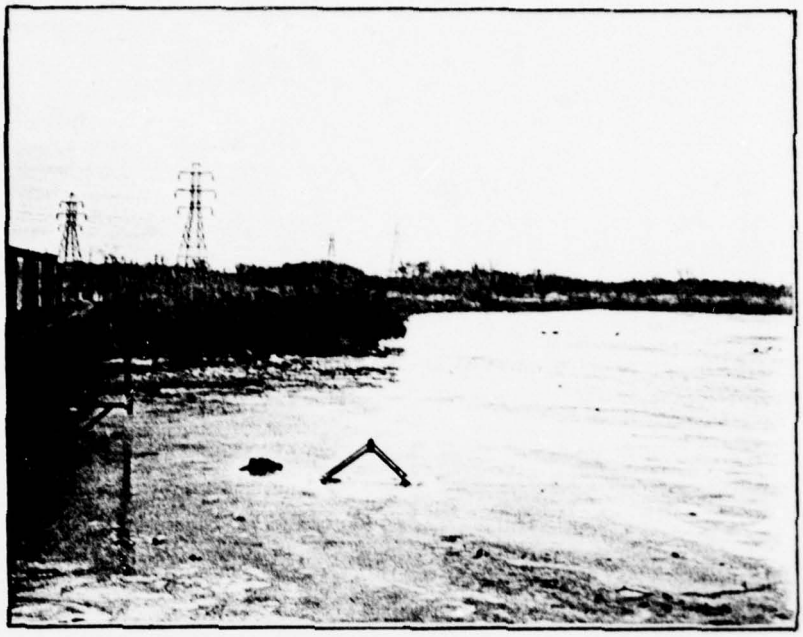
East end of dam

January 1979



County bridge over Salem River at East end of dam

January 1979

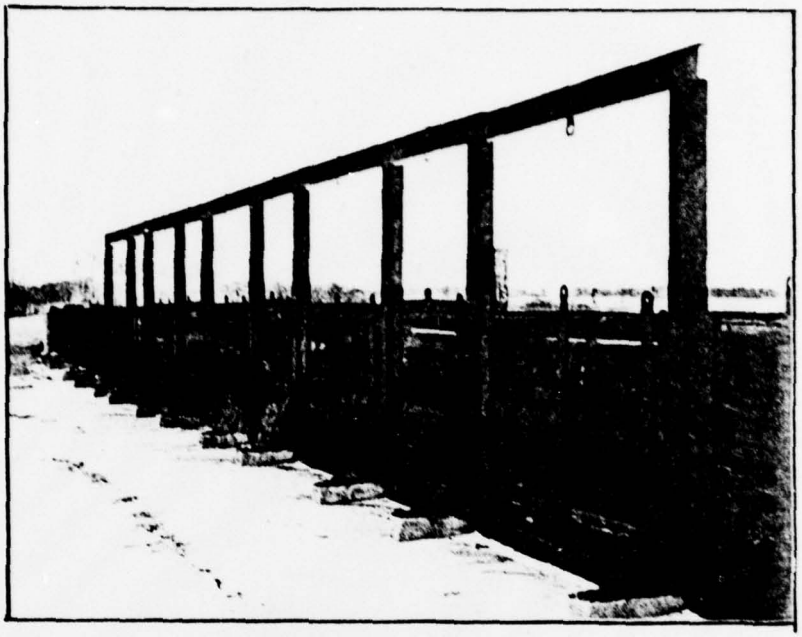


View East along dam

January 1979

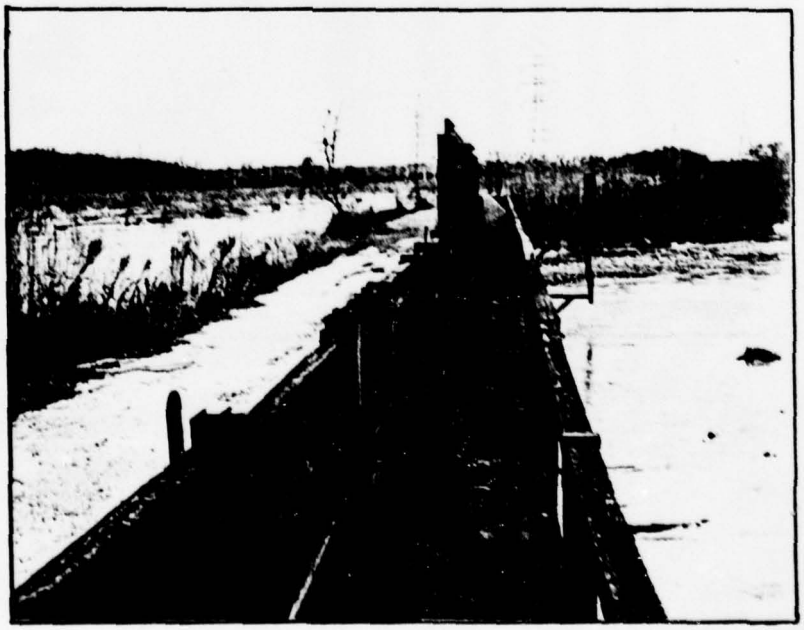
Steel sheeting at left spillway abutment

January 1979



Hoist brackets for flashboards

January 1979



View East along catwalk

January 1979

Dam No. 00117

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Drainage Area = 60 sq. mi.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): +4.3 (1100 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): +12.5* (19460 acre-feet)

ELEVATION MAXIMUM DESIGN POOL: +4.8

ELEVATION TOP DAM: +13.0 (top of roadway)

CREST:

a. Elevation +7.5
b. Type Broad crested weir
c. Width 14'
d. Length 135'
e. Location Spillover near left abutment
f. Number and Type of Gates 20 sets of timber flashboards

OUTLET WORKS: None

a. Type
b. Location
c. Entrance inverts
d. Exit inverts
e. Emergency draindown facilities None

HYDROMETEOROLOGICAL GAGES: None at dam

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 2030 cfs (gate capacity at Munson Dam)

* Top crest of Munson Dam

BY RGL DATE Feb '79 | LOUIS BERGER & ASSOCIATES INC. | SHEET NO A1 OF
CHKD. BY DATE | Munson & Brown Dams | PROJECT C226
SUBJECT

Snyder Coefficients (from Corps)

$C_T = 4.51$
$C_p = 0.70$

Drainage Area = 60.0 sq. mi.

Length of longest watercourse = 15.80 mi

Length along watercourse to centroid = 3.90 mi.

$\therefore t_p = 4.51(15.8 \times 3.90)^{0.3}$

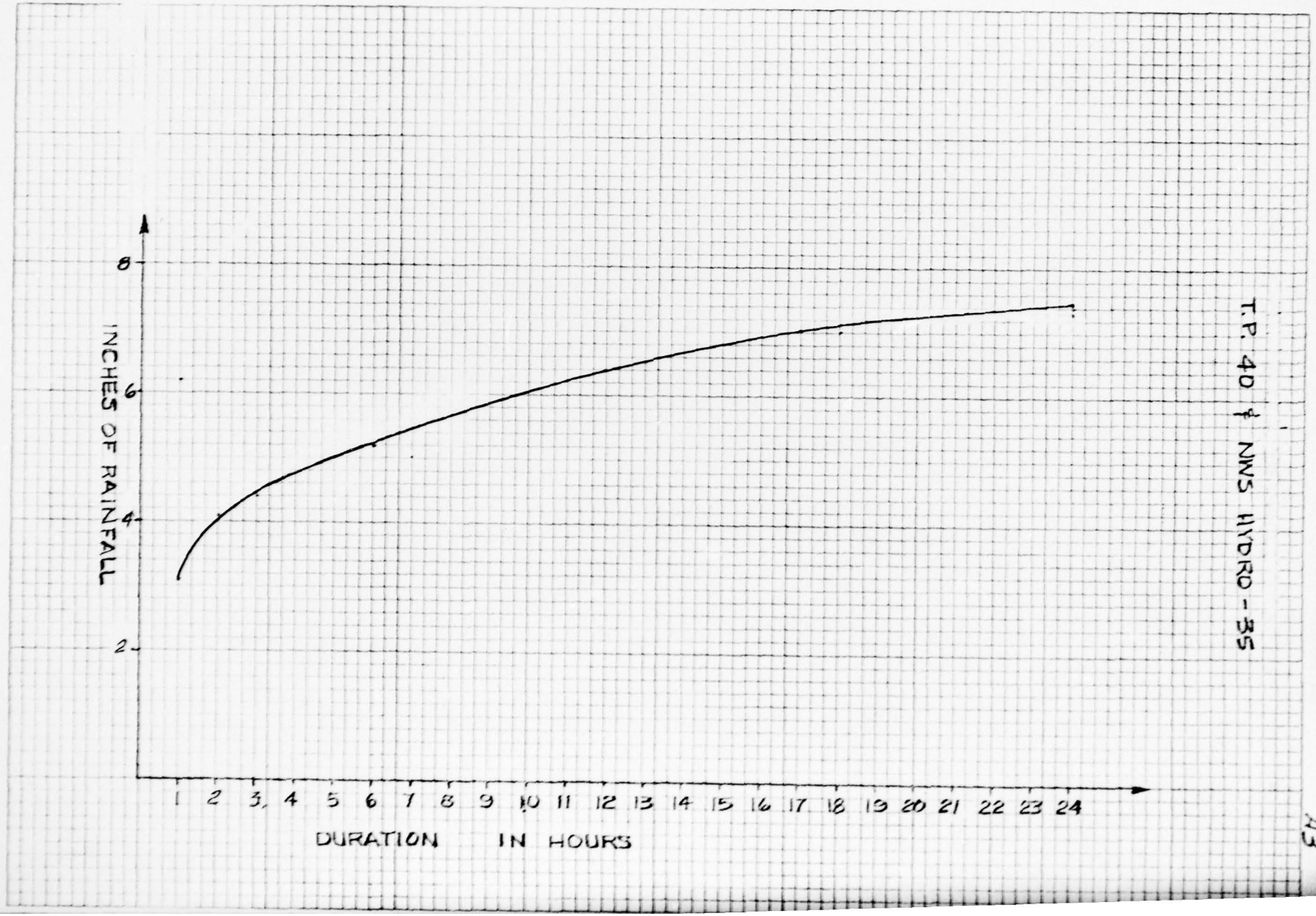
$= 19.89$ hours

The following calculations are based on the fact that Munson & Brown Dams impound the same lake. Moreover the spillway gates at Brown Dam are assumed to be closed under flood conditions

BY RGL DATE Mar '79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A2 OF
CHKD. BY DATE Munson & Brown Dam PROJECT C226
SUBJECT

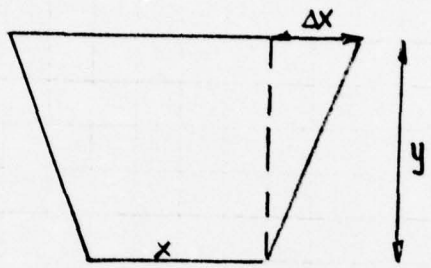
Precipitation data from TP-40 and NOAA Technical Memo NWS-Hydro 35

Time	Precip	Δ	Rearrange
1	3.10	3.10	0.05
2	4.00	1.10	0.05
3	4.40	0.40	0.10
4	4.71	0.31	0.10
5	4.96	0.25	0.10
6	5.20	0.20	0.15
7	5.40	0.20	0.20
8	5.60	0.20	0.20
9	5.80	0.20	0.20
10	6.00	0.20	0.31
11	6.20	0.20	1.1
12	6.40	0.20	3.10
13	6.55	0.15	0.4
14	6.70	0.15	0.25
15	6.80	0.10	0.20
16	6.90	0.10	0.20
17	7.00	0.10	0.20
18	7.10	0.10	0.20
19	7.20	0.10	0.15
20	7.25	0.05	0.10
21	7.30	0.05	0.10
22	7.35	0.05	0.05
23	7.40	0.05	0.05
24	7.45	0.05	0.05



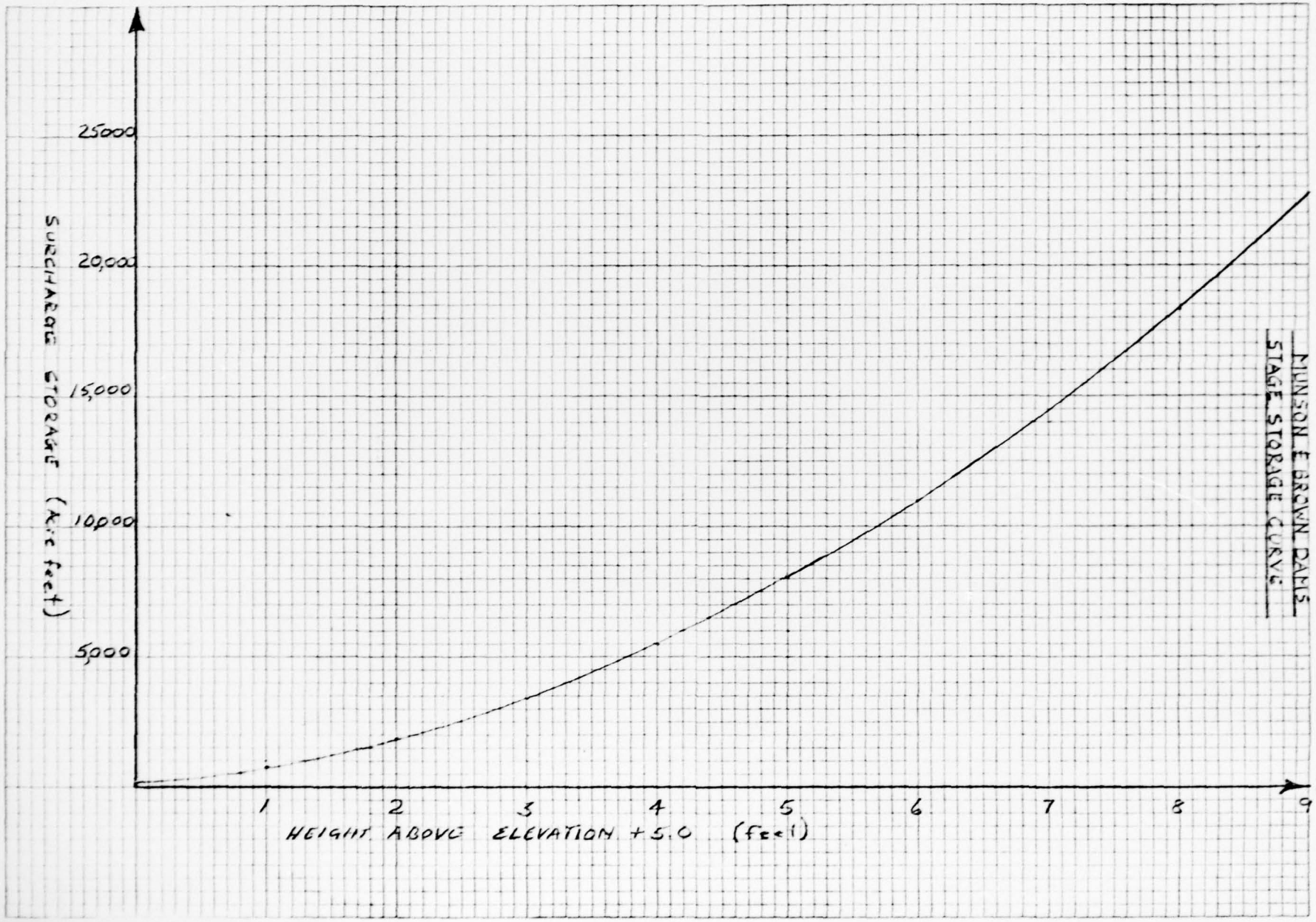
BY RGL DATE Feb '79 LOUIS BERGER & ASSOCIATES INC. SHEET NO. A4 OF
CHKD. BY DATE Munson & Brown Dams PROJECT C 226
SUBJECT Storage

Area at elev. +4.5 = 171 acres
Area at elev. +10.0 = 2745 acres



Increment in vol. $\Delta V = (x + \Delta x)y$

Height above sea level	Surcharge storage
0	0
2	0
4	0
4.5	0
5	144
6	783
7	1890
8	3465
9	5508
10	8019
11	10998
12	14445
13	18360
14	22743
15	27594



BY RGL DATE FEB '79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A6 OF
CHKD. BY DATE MUNSON & BROWN DAMS PROJECT C226
SUBJECT DISCHARGE

Munson:

1-48" ϕ sluicegate
A = 12.57 ft² C = 0.62
Inv. El. = -4.50

12-4'x4' sluicegates
A = 192 ft² C = 0.62
Inv. El. = +2.0

Assume tailwater at elev. +8.5

ELEV.	H	Q		H	Q
8.50	0	0		0	0
9.00	0.50	44		0.5	675
10.00	1.50	77		1.5	1170
11.00	2.50	99		2.5	1510
12.00	3.50	117	TOP OF DAM	3.5	1787
13.0	4.50	133		4.5	2026
14.0	5.50	147		5.5	2240
15.0	6.50	159		6.5	2436

over dam L = 150 C = 2.8

13.0	0.5	148
14.0	1.5	772
15.0	2.5	1660

Brown:

Since the gates at Brown Dam are normally closed, they are assumed closed for discharge calculation:
L = 2225.5' (including flow over flashboards)
Top of Dam

Elev.	H	Q
14.0	1.0	6454
15.0	2.0	18255

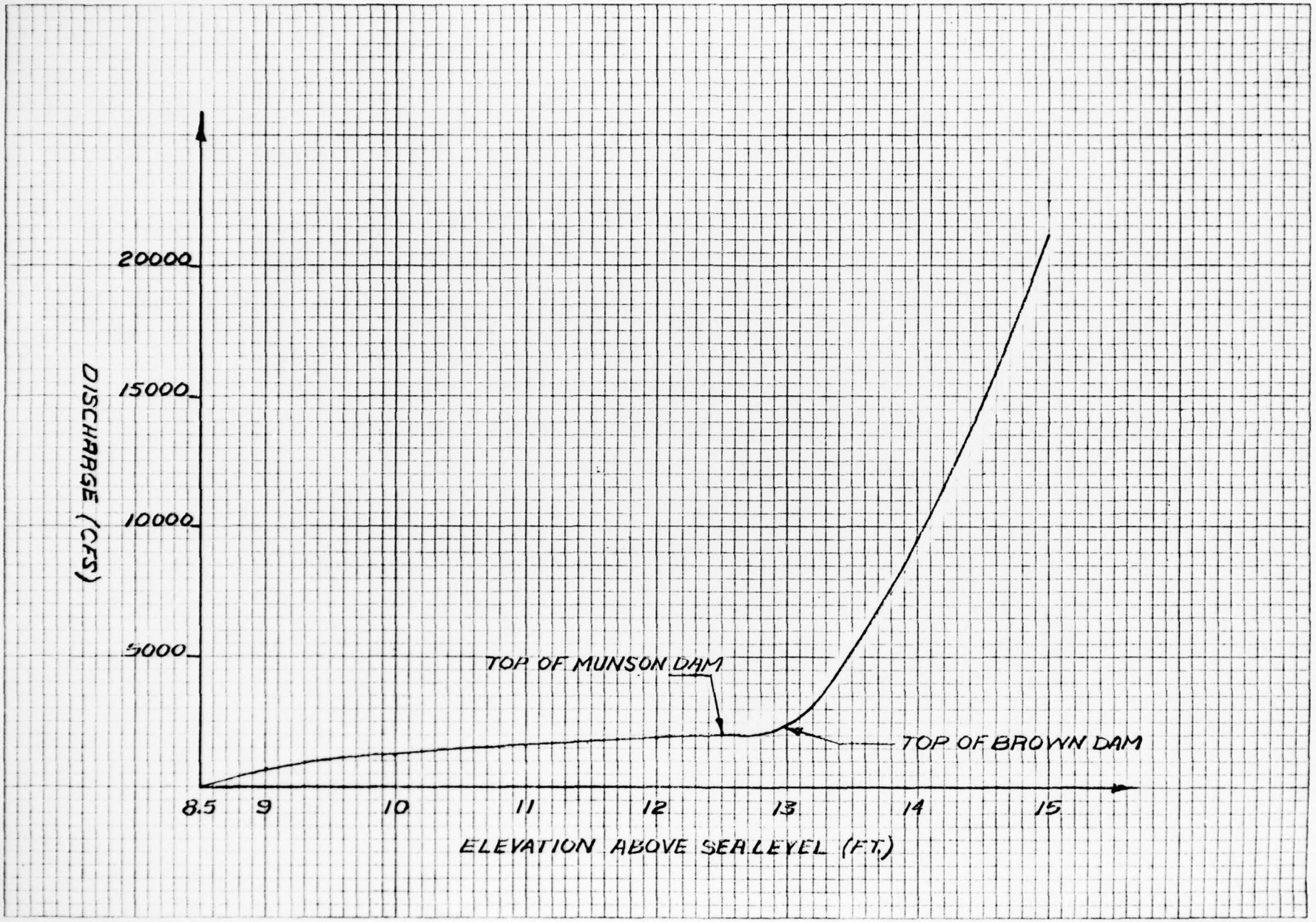
BY RGL DATE Feb '79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A7 OF
CHKD. BY DATE Munson & Brown Dams PROJECT C 226
SUBJECT Combined Discharges

assuming tailwater of +8.5

Elev.	Q
8.50	0
9.0	719
10.0	1247
11.0	1609
12.0	1904
13.0	2307
14.0	9613
15.0	22510

Summary of discharge & storage data

Elev.	Storage	Discharge
8.5	4487	0
9	5508	719
10	8019	1247
11	10998	1609
12	14445	1904
12.5	16403	2032
13	18360	2307
13.5	20552	5015
14	22743	9613
15	27594	22510



8H

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	2	0	0	0	0	0	0	0	0

JOPER	NWT
3	0

********** ************ ********** ************ **********

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
67	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	1	60.00	0.0	60.00	0.0	0.0	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
24	0.0	0.0	0.0

PRECIP PATTERN

0.05	0.05	0.10	0.10	0.10	0.15	0.20	0.20	0.20	0.31
1.10	3.10	0.40	0.25	0.20	0.20	0.20	0.20	0.15	0.10
0.10	0.05	0.05	0.05						

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	0.50	0.10	0.0	0.0

UNIT HYDROGRAPH DATA

TP= 19.90 CP=0.70 NTA= 0

RECESSION DATA

STRTQ= 0.0 QRCSN= 0.0 RTIOR= 1.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=11.41 AND R= 7.52 INTERVALS

UNIT HYDROGRAPH 47 END-OF-PERIOD ORDINATES, LAG= 19.96 HOURS, CP= 0.69 VOL= 1.00

44.	164.	329.	517.	717.	923.	1109.	1249.	1337.	1375.
1358.	1263.	1117.	978.	856.	749.	656.	574.	503.	440.
385.	337.	295.	258.	226.	198.	173.	152.	133.	116.
102.	89.	78.	68.	60.	52.	46.	40.	35.	31.
27.	24.	21.	18.	16.	14.	12.			

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.05	0.00	0.
2	0.05	0.00	0.
3	0.10	0.00	0.

BY D.J.M. DATE 4-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A10

CHKD. BY _____ DATE _____ MUNSON DAM INSPECTION PROJECT C-226

SUBJECT _____ & BROWN DAM

4	0.10	0.00	0.
5	0.10	0.00	0.
6	0.15	0.00	0.
7	0.20	0.00	0.
8	0.20	0.00	0.
9	0.20	0.00	0.
10	0.31	0.11	5.
11	1.10	0.90	58.
12	3.10	2.90	312.
13	0.40	0.20	837.
14	0.25	0.05	1533.
15	0.20	0.00	2319.
16	0.20	0.00	3151.
17	0.20	0.00	3980.
18	0.20	0.00	4707.
19	0.15	0.00	5244.
20	0.10	0.00	5571.
21	0.10	0.00	5679.
22	0.05	0.00	5539.
23	0.05	0.00	5116.
24	0.05	0.00	4535.
25	0.0	0.0	3976.
26	0.0	0.0	3481.
27	0.0	0.0	3047.
28	0.0	0.0	2668.
29	0.0	0.0	2335.
30	0.0	0.0	2044.
31	0.0	0.0	1789.
32	0.0	0.0	1566.
33	0.0	0.0	1371.
34	0.0	0.0	1200.
35	0.0	0.0	1051.
36	0.0	0.0	920.
37	0.0	0.0	805.
38	0.0	0.0	705.
39	0.0	0.0	617.
40	0.0	0.0	540.
41	0.0	0.0	473.
42	0.0	0.0	414.
43	0.0	0.0	362.
44	0.0	0.0	317.
45	0.0	0.0	278.
46	0.0	0.0	243.
47	0.0	0.0	213.
48	0.0	0.0	186.
49	0.0	0.0	163.
50	0.0	0.0	143.
51	0.0	0.0	125.
52	0.0	0.0	109.
53	0.0	0.0	96.
54	0.0	0.0	84.
55	0.0	0.0	73.
56	0.0	0.0	64.
57	0.0	0.0	55.
58	0.0	0.0	39.
59	0.0	0.0	3.
60	0.0	0.0	1.
61	0.0	0.0	0.
62	0.0	0.0	0.
63	0.0	0.0	0.
64	0.0	0.0	0.
65	0.0	0.0	0.
66	0.0	0.0	0.
67	0.0	0.0	0.
68	0.0	0.0	0.
69	0.0	0.0	0.
70	0.0	0.0	0.
71	0.0	0.0	0.
72	0.0	0.0	0.
73	0.0	0.0	0.
74	0.0	0.0	0.
75	0.0	0.0	0.
76	0.0	0.0	0.
77	0.0	0.0	0.
78	0.0	0.0	0.
79	0.0	0.0	0.
80	0.0	0.0	0.
81	0.0	0.0	0.
82	0.0	0.0	0.
83	0.0	0.0	0.
84	0.0	0.0	0.
85	0.0	0.0	0.
86	0.0	0.0	0.
87	0.0	0.0	0.
88	0.0	0.0	0.
89	0.0	0.0	0.
90	0.0	0.0	0.
91	0.0	0.0	0.
92	0.0	0.0	0.
93	0.0	0.0	0.
94	0.0	0.0	0.
95	0.0	0.0	0.
96	0.0	0.0	0.
97	0.0	0.0	0.
98	0.0	0.0	0.
99	0.0	0.0	0.
100	0.0	0.0	0.
101	0.0	0.0	0.
102	0.0	0.0	0.
103	0.0	0.0	0.
104	0.0	0.0	0.
105	0.0	0.0	0.
106	0.0	0.0	0.
107	0.0	0.0	0.
108	0.0	0.0	0.
109	0.0	0.0	0.
110	0.0	0.0	0.
111	0.0	0.0	0.
112	0.0	0.0	0.
113	0.0	0.0	0.
114	0.0	0.0	0.
115	0.0	0.0	0.
116	0.0	0.0	0.
117	0.0	0.0	0.
118	0.0	0.0	0.
119	0.0	0.0	0.
120	0.0	0.0	0.
121	0.0	0.0	0.
122	0.0	0.0	0.
123	0.0	0.0	0.
124	0.0	0.0	0.
125	0.0	0.0	0.

BY D.J.M. DATE 4-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A11 OF

CHKD. BY ______ DATE ______ MONSON DAM INSPECTION PROJECT C226

SUBJECT & BROWN DAM

126	0.0	0.0	0.
127	0.0	0.0	0.
128	0.0	0.0	0.
129	0.0	0.0	0.
130	0.0	0.0	0.
131	0.0	0.0	0.
132	0.0	0.0	0.
133	0.0	0.0	0.
134	0.0	0.0	0.
135	0.0	0.0	0.
136	0.0	0.0	0.
137	0.0	0.0	0.
138	0.0	0.0	0.
139	0.0	0.0	0.
140	0.0	0.0	0.
141	0.0	0.0	0.
142	0.0	0.0	0.
143	0.0	0.0	0.
144	0.0	0.0	0.
145	0.0	0.0	0.
146	0.0	0.0	0.
147	0.0	0.0	0.
148	0.0	0.0	0.
149	0.0	0.0	0.
150	0.0	0.0	0.
SUM	7.61	4.16	80142.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5679.	5596.	4502.	2193.	80141.
INCHES		0.87	2.79	4.08	4.14
AC-FT		2777.	8935.	13054.	13253.

HYDROGRAPH ROUTING

ROUTING THROUGH RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
67	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	0.

STORAGE=	4487.	5508.	8019.	10998.	14445.	16403.	18360.	20552.	22743.	27594.
OUTFLOW=	0.	719.	1247.	1609.	1904.	2032.	2307.	5015.	9613.	22510.

TIME	EOP STOR	AVG IN	EOP OUT
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.

BY R.J.M. DATE 4-71

CHKD. BY _____ DATE _____

SUBJECT MUNSON DAM INSPECTION & BROWN DAM

LOUIS BERGER & ASSOCIATES INC.

SHEET NO A12 OF _____

PROJECT C-226

9	0.	0.	0.
10	0.	2.	0.
11	6.	31.	0.
12	36.	185.	0.
13	131.	574.	0.
14	327.	1185.	0.
15	645.	1926.	0.
16	1097.	2735.	0.
17	1687.	3566.	0.
18	2405.	4344.	0.
19	3227.	4976.	0.
20	4121.	5407.	0.
21	5020.	5625.	375.
22	5850.	5609.	791.
23	6587.	5328.	946.
24	7218.	4826.	1079.
25	7734.	4255.	1187.
26	8148.	3729.	1263.
27	8475.	3264.	1302.
28	8730.	2857.	1333.
29	8921.	2501.	1357.
30	9057.	2190.	1373.
31	9146.	1917.	1384.
32	9194.	1678.	1390.
33	9207.	1469.	1391.
34	9190.	1286.	1389.
35	9147.	1126.	1384.
36	9081.	985.	1376.
37	8997.	862.	1366.
38	8897.	755.	1354.
39	8784.	661.	1340.
40	8659.	579.	1325.
41	8525.	506.	1309.
42	8384.	443.	1291.
43	8236.	388.	1273.
44	8083.	340.	1255.
45	7927.	297.	1228.
46	7770.	260.	1195.
47	7613.	228.	1162.
48	7457.	199.	1129.
49	7302.	175.	1096.
50	7148.	153.	1064.
51	6997.	134.	1032.
52	6849.	117.	1001.
53	6703.	103.	970.
54	6560.	90.	940.
55	6420.	79.	911.
56	6283.	69.	882.
57	6149.	60.	854.
58	6018.	47.	826.
59	5887.	21.	799.
60	5758.	2.	772.
61	5633.	0.	745.
62	5512.	0.	720.
63	5399.	0.	642.
64	5299.	0.	572.
65	5209.	0.	509.
66	5130.	0.	453.
67	5059.	0.	403.
68	4996.	0.	359.
69	4940.	0.	319.
70	4890.	0.	284.
71	4846.	0.	253.
72	4807.	0.	225.
73	4771.	0.	200.
74	4740.	0.	178.
75	4712.	0.	159.
76	4687.	0.	141.
77	4665.	0.	126.
78	4646.	0.	112.
79	4628.	0.	100.
80	4613.	0.	89.
81	4599.	0.	79.
82	4587.	0.	70.
83	4576.	0.	62.
84	4566.	0.	56.
85	4557.	0.	49.
86	4550.	0.	44.
87	4543.	0.	39.
88	4537.	0.	35.
89	4531.	0.	31.
90	4526.	0.	28.
91	4522.	0.	25.
92	4518.	0.	22.
93	4515.	0.	19.
94	4512.	0.	17.
95	4509.	0.	15.
96	4506.	0.	14.
97	4504.	0.	12.
98	4502.	0.	11.
99	4501.	0.	10.
100	4499.	0.	9.
101	4498.	0.	8.
102	4497.	0.	7.
103	4496.	0.	6.
104	4495.	0.	5.
105	4494.	0.	5.
106	4493.	0.	4.
107	4492.	0.	4.
108	4492.	0.	3.
109	4491.	0.	3.
110	4491.	0.	3.
111	4490.	0.	2.
112	4490.	0.	2.
113	4490.	0.	2.
114	4489.	0.	2.
115	4489.	0.	1.
116	4489.	0.	1.
117	4489.	0.	1.
118	4488.	0.	1.
119	4488.	0.	1.
120	4488.	0.	1.
121	4488.	0.	1.
122	4488.	0.	1.
123	4488.	0.	1.
124	4488.	0.	1.
125	4488.	0.	0.
126	4488.	0.	0.
127	4488.	0.	0.
128	4487.	0.	0.
129	4487.	0.	0.
130	4487.	0.	0.

131	4487.	0.	0.
132	4487.	0.	0.
133	4487.	0.	0.
134	4487.	0.	0.
135	4487.	0.	0.
136	4487.	0.	0.
137	4487.	0.	0.
138	4487.	0.	0.
139	4487.	0.	0.
140	4487.	0.	0.
141	4487.	0.	0.
142	4487.	0.	0.
143	4487.	0.	0.
144	4487.	0.	0.
145	4487.	0.	0.
146	4487.	0.	0.
147	4487.	0.	0.
148	4487.	0.	0.
149	4487.	0.	0.
150	4487.	0.	0.
SUM			52995.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1391.	1390.	1370.	1193.	52995.
INCHES		0.22	0.85	2.22	2.74
AC-FT		690.	2718.	7104.	8764.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	67	5679.	5596.	4502.	2193.	60.00
ROUTED TO	67	1391.	1390.	1370.	1193.	60.00